Appendix C – SAR Test Setup Photos

Figure 1 – Front of Device Main Antenna Touch Position

Figure 2 – Side of Device Main Antenna Touch Position

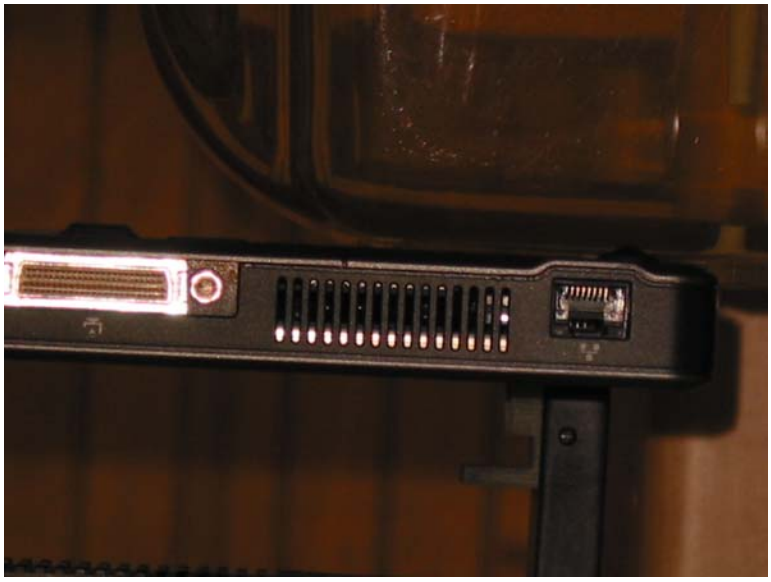


Figure 3 – Side of Device Aux Antenna Touch Position

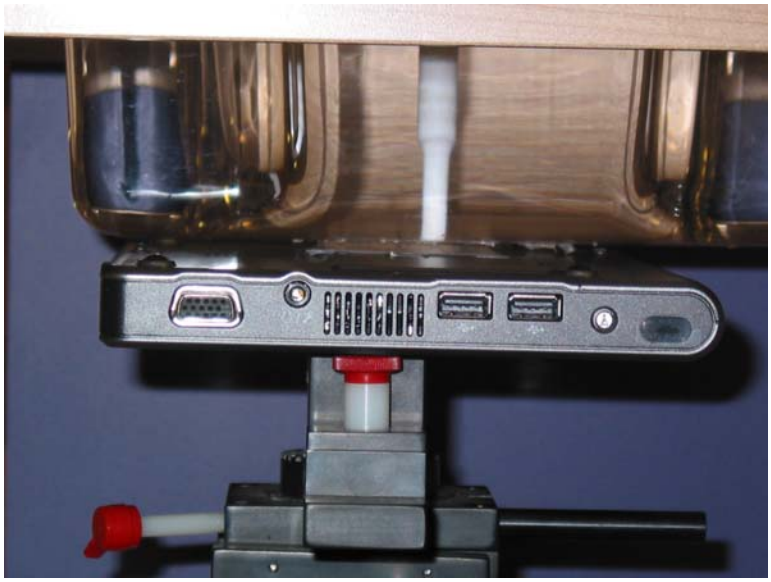


Figure 4 – Front of Device Main Antenna Touch Position

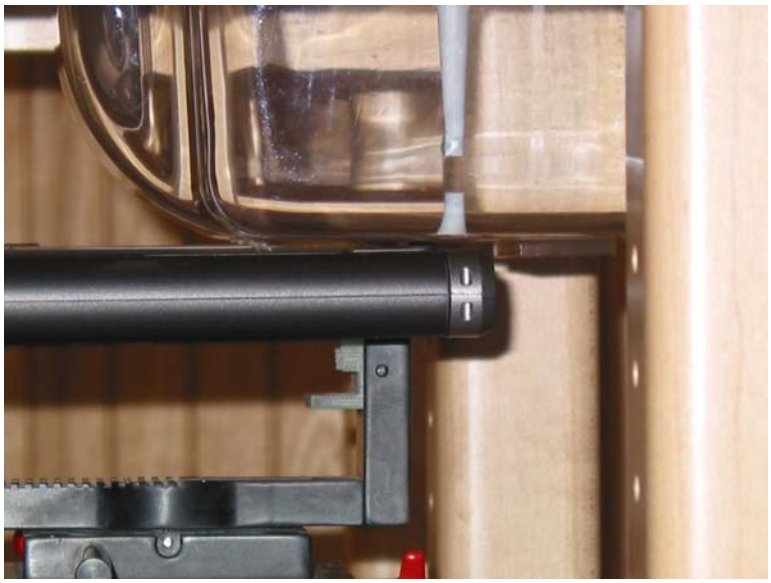


Figure 5 – Side of Device Main Antenna Touch Position

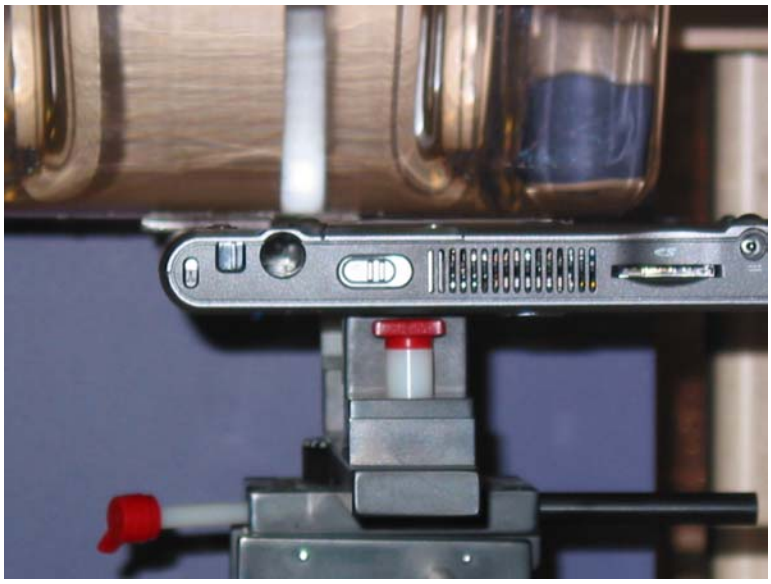


Figure 6 – Front of Device Aux Antenna Touch Position

Figure 7 – Side of Device Aux Antenna Touch Position

Figure 8 – Front of Device

Figure 9 – Back of Device

Figure 10 – Bottom case of Device

Figure 11 – Front of Battery

Figure 12 – Back of Battery

Figure 13 – Body Sugar Based Solution Tissue Depth

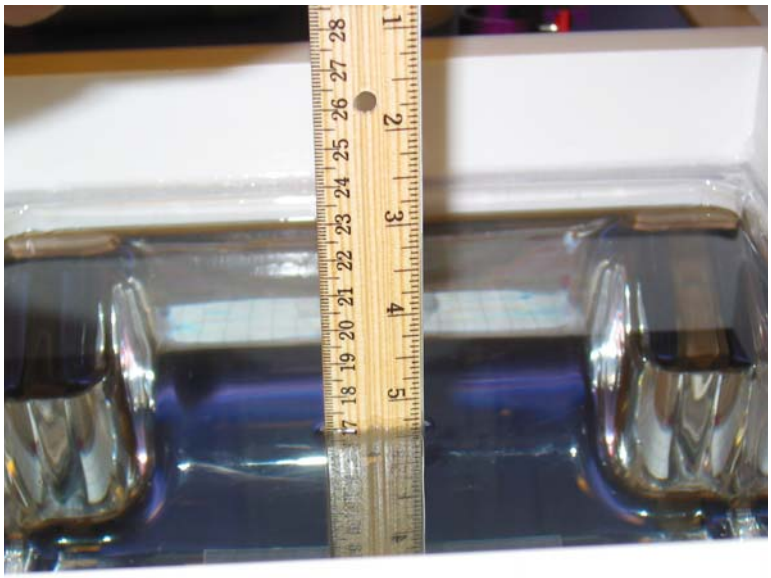


Figure 14 – Body Glycol Based Solution Tissue Depth

Appendix D – Probe Calibration Data Sheets

NCL CALIBRATION LABORATORIES

Calibration File No.: CP-607

Client.: RFEL

C E R T I F I C A T E OF C A L I B R A T I O N

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe 5200 MHz

Manufacturer: APREL Laboratories
Model No.: E-020
Serial No.: 215

BODY Calibration

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2
Project No: RFEL-Probe-215-Calibration-5166

Calibrated: 10th June 2005
Released on: 10th June 2005

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: Signature On File

NCL CALIBRATION LABORATORIES
51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6
Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4161

Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 215.

References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure
IEEE 1528 “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”
SSI-TP-011 Tissue Calibration Procedure

Conditions

Probe 215 was a new probe taken from stock prior to calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C
Temperature of the Tissue: 21 °C +/- 0.5°C

We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

Stuart Nicol
Director Product Development

Janusz Lokaj
Member of Engineering Staff
(Calibration Engineer)

Calibration Results Summary

Probe Type:	E-Field Probe E-020
Serial Number:	215
Frequency:	5200 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	**<**5 mm
Tip Length:	60 mm
Total Length:	290 mm

*Resistive to recommended tissue recipes per IEEE-1528

Sensitivity in Air

Channel X:	1.2 $\mu V/(V/m)^2$
Channel Y:	1.2 $\mu V/(V/m)^2$
Channel Z:	1.2 $\mu V/(V/m)^2$
Diode Compression Point:	95 mV

Sensitivity in Body Tissue

Frequency: 5200 MHz

Epsilon: 43.4 (+/-5%) **Sigma:** 5.7 S/m (+/-10%)

ConvF

Channel X: 2.8

Channel Y: 2.8

Channel Z: 2.8

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

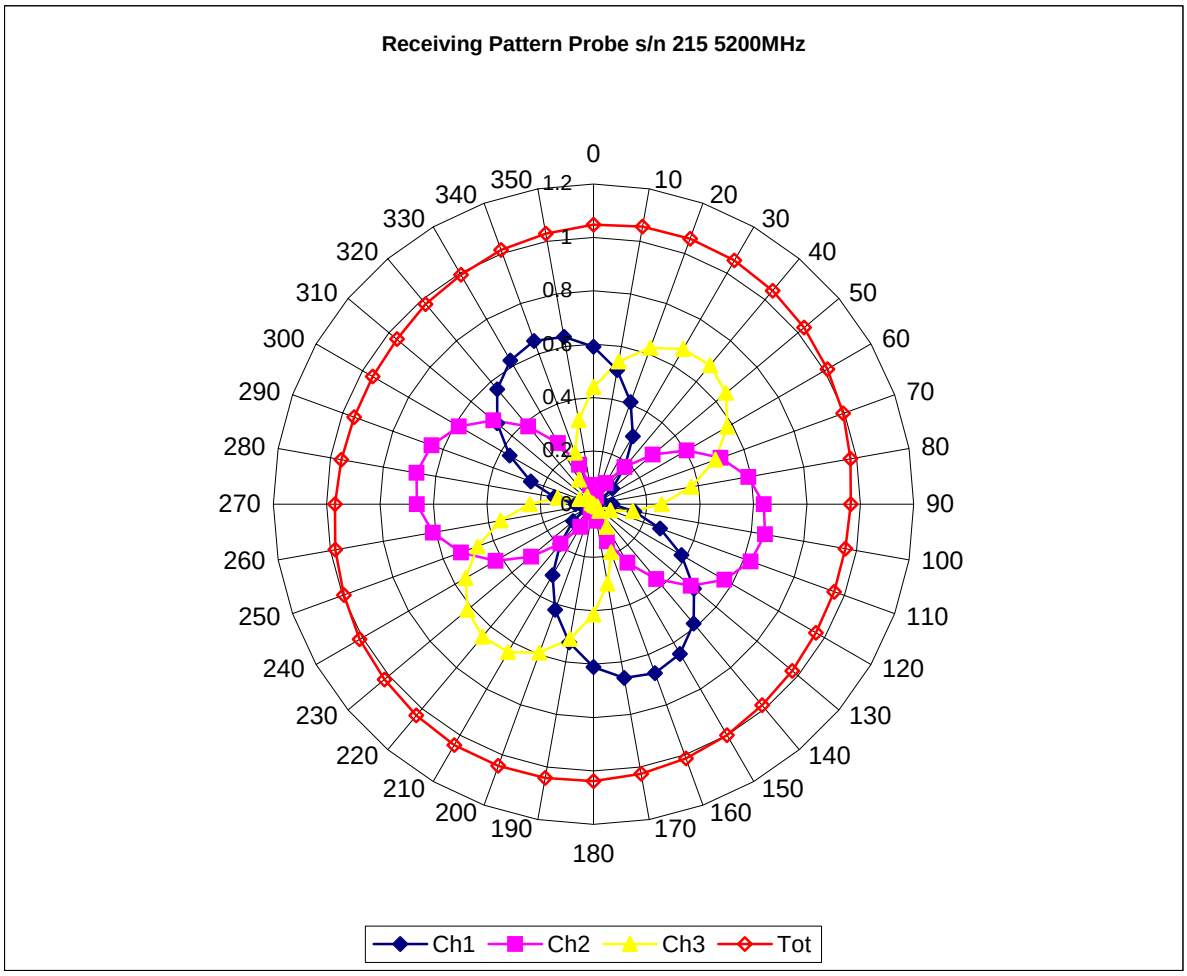
Boundary Effect:

Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.44mm.

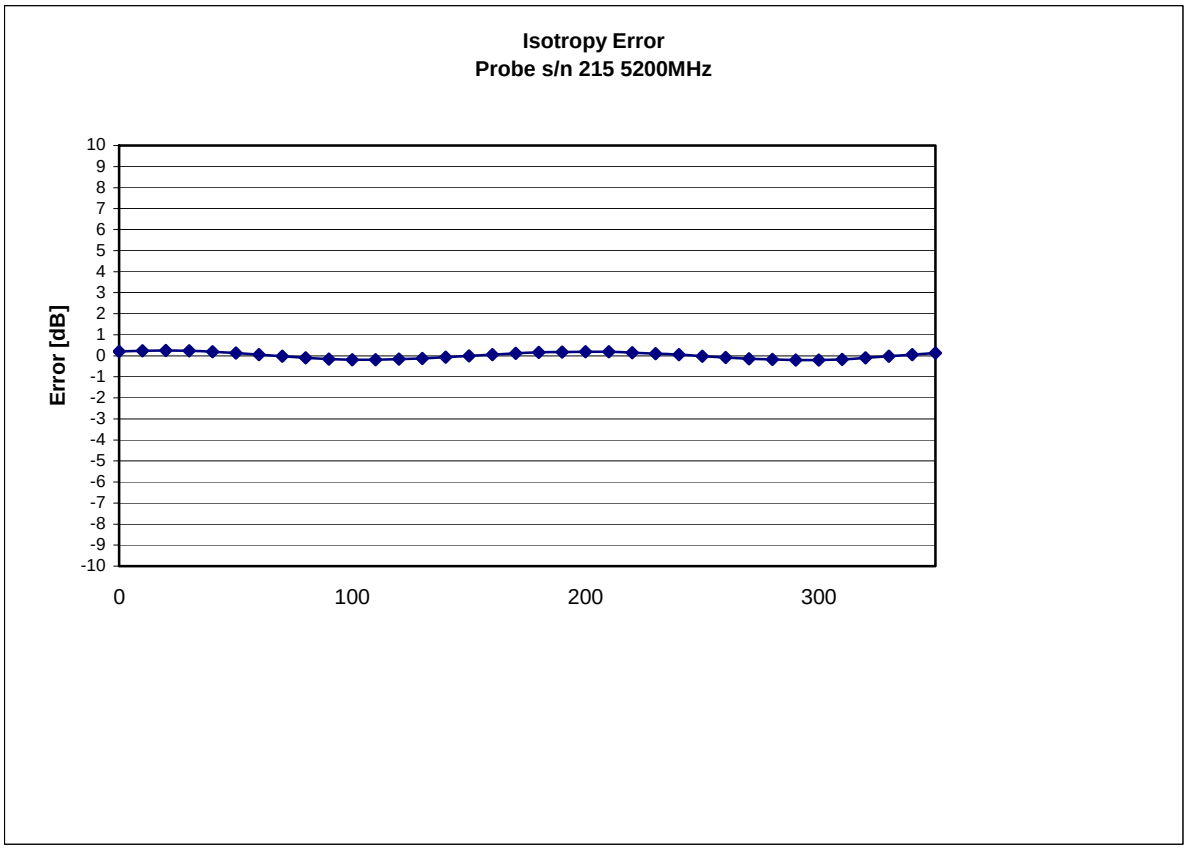
Spatial Resolution:

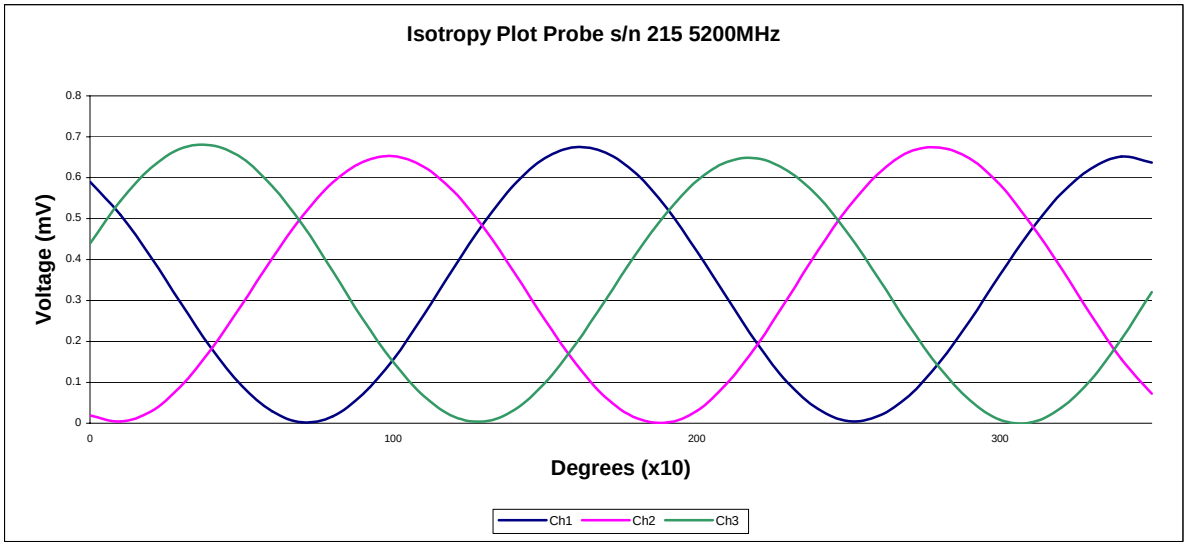
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Receiving Pattern 5200 MHz (Air)



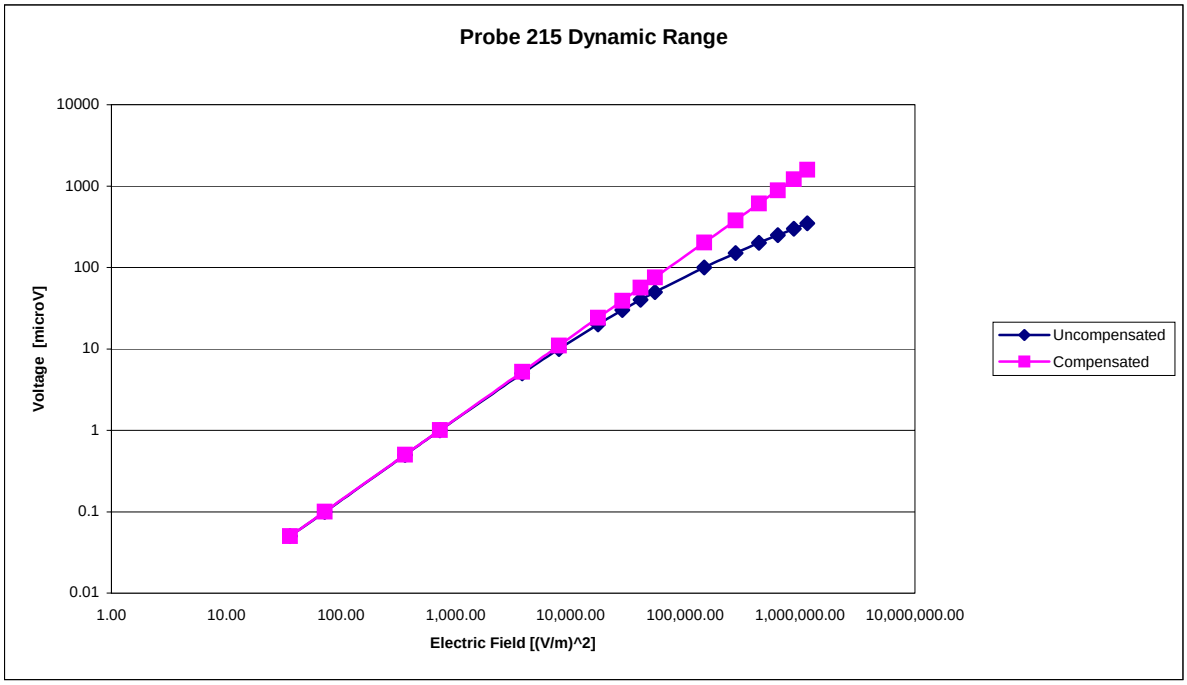
Isotropy Error 5200 MHz (Air)



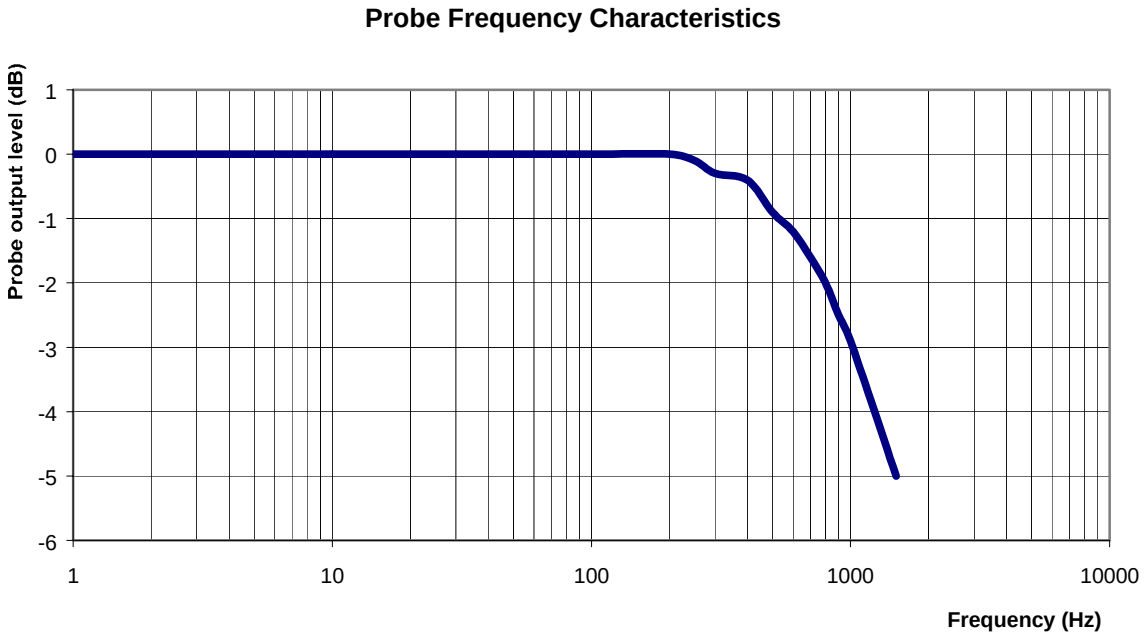


Isotropicity in Tissue: 0.10 dB

Dynamic Range



Video Bandwidth



Video Bandwidth at 500 Hz 1 dB
Video Bandwidth at 1.02 KHz: 3 dB

Conversion Factor Uncertainty Assessment

Frequency:		5200MHz	
Epsilon:	43.4 (+/-5%)	**Sigma:**	5.7 S/m (+/-10%)
ConvF			
Channel X:	2.8	7%(K=2)	
Channel Y:	2.8	7%(K=2)	
Channel Z:	2.8	7%(K=2)	

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 MΩ.

Boundary Effect:

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2005.

NCL CALIBRATION LABORATORIES

Calibration File No.: CP-608

Client.: RFEL

C E R T I F I C A T E OF C A L I B R A T I O N

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe 5600 MHz

Manufacturer: APREL Laboratories
Model No.: E-020
Serial No.: 215

BODY Calibration

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2
Project No: RFEL-Probe-215-Calibration-5166

Calibrated: 10th June 2005
Released on: 10th June 2005

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: Signature On File

NCL CALIBRATION LABORATORIES
51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6
Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4161

Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 215.

References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure
IEEE 1528 “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”
SSI-TP-011 Tissue Calibration Procedure

Conditions

Probe 215 was a new probe taken from stock prior to calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C
Temperature of the Tissue: 21 °C +/- 0.5°C

We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

Stuart Nicol
Director Product Development

Janusz Lokaj
Member of Engineering Staff
(Calibration Engineer)

Calibration Results Summary

Probe Type:	E-Field Probe E-020
Serial Number:	215
Frequency:	5600 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	**<**5 mm
Tip Length:	60 mm
Total Length:	290 mm

*Resistive to recommended tissue recipes per IEEE-1528

Sensitivity in Air

Channel X:	1.2 $\mu V/(V/m)^2$
Channel Y:	1.2 $\mu V/(V/m)^2$
Channel Z:	1.2 $\mu V/(V/m)^2$
Diode Compression Point:	95 mV

Sensitivity in Body Tissue

Frequency: 5600 MHz

Epsilon: 46.0 (+/-5%) **Sigma:** 6.1 S/m (+/-10%)

ConvF

Channel X: 2.31

Channel Y: 2.31

Channel Z: 2.31

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

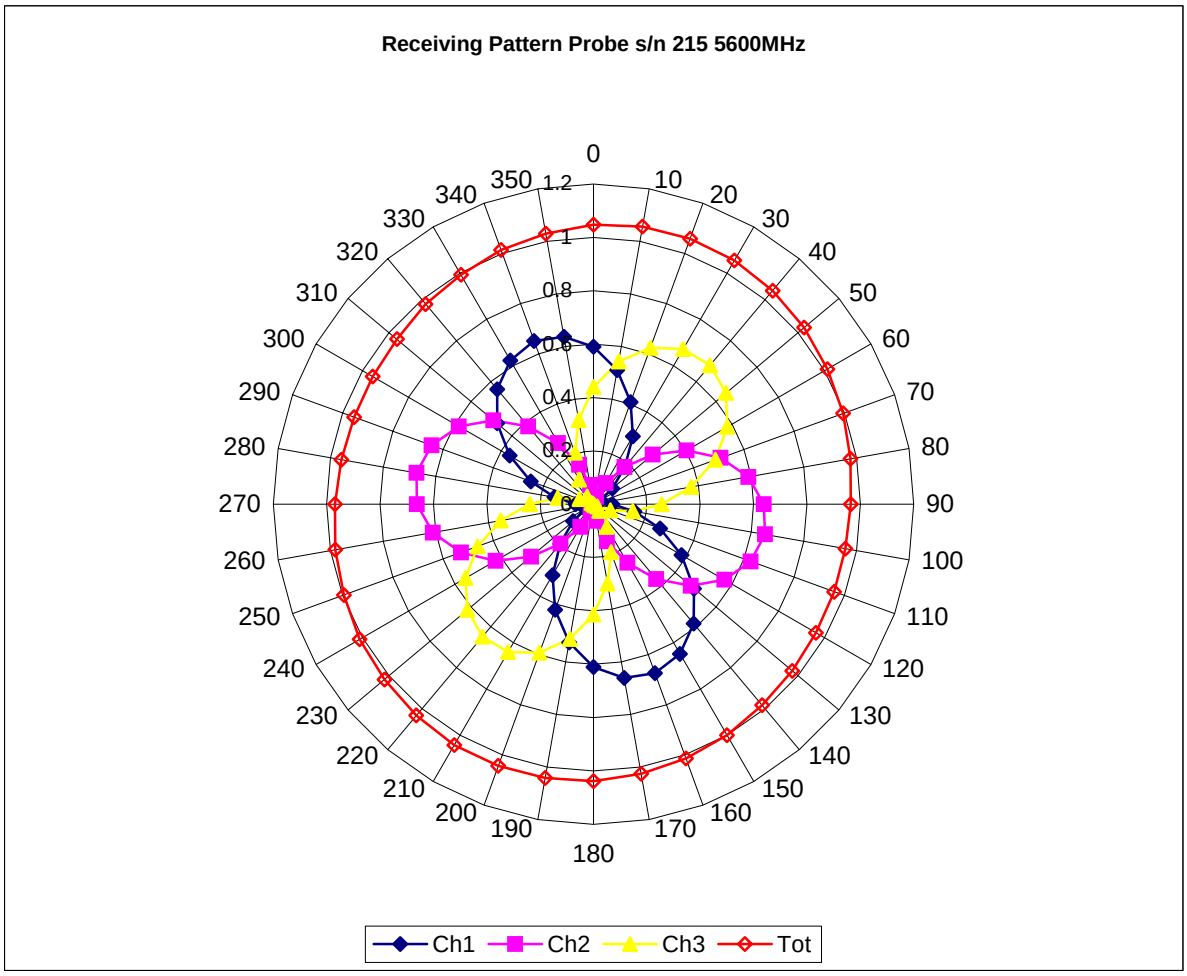
Boundary Effect:

Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.44mm.

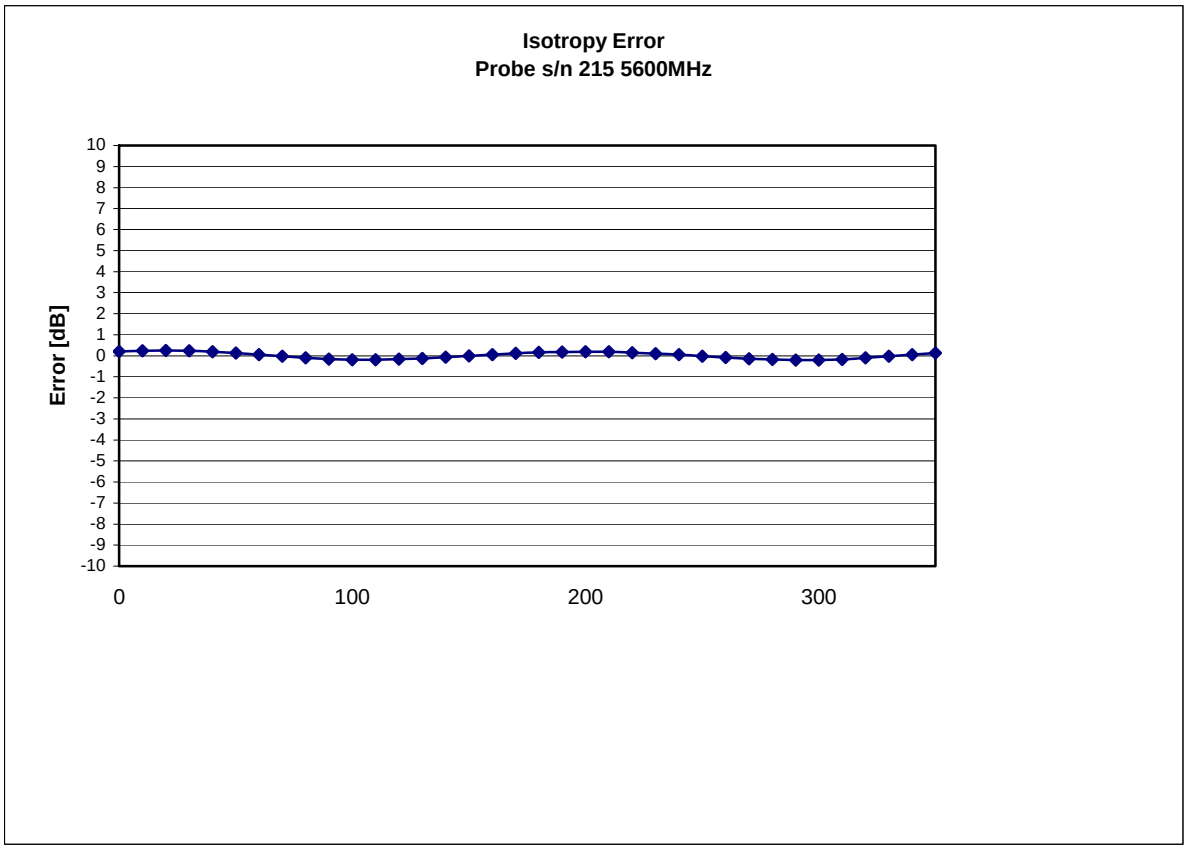
Spatial Resolution:

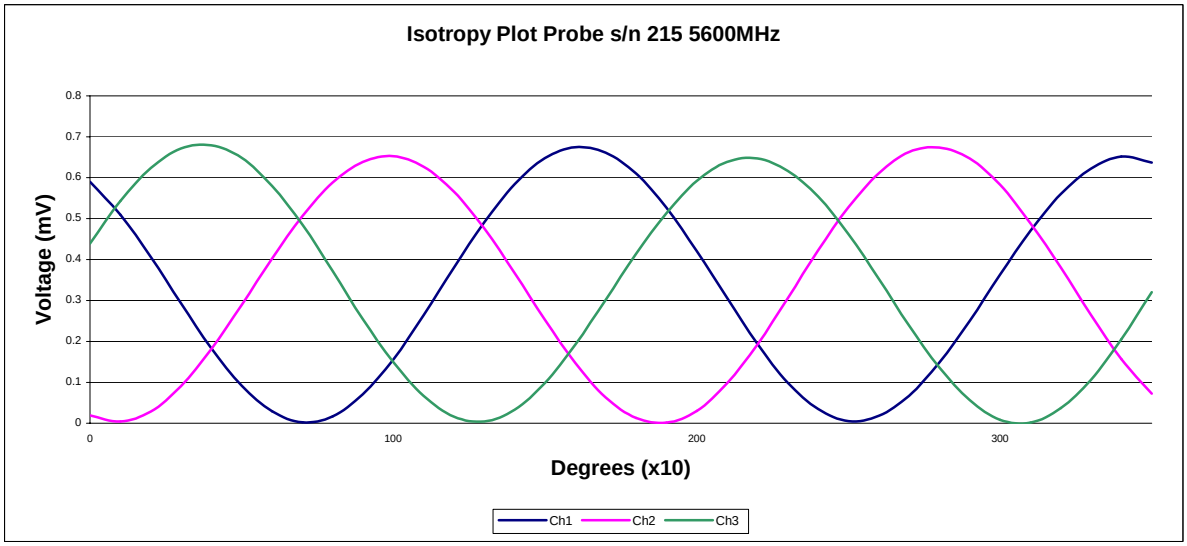
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Receiving Pattern 5600 MHz (Air)



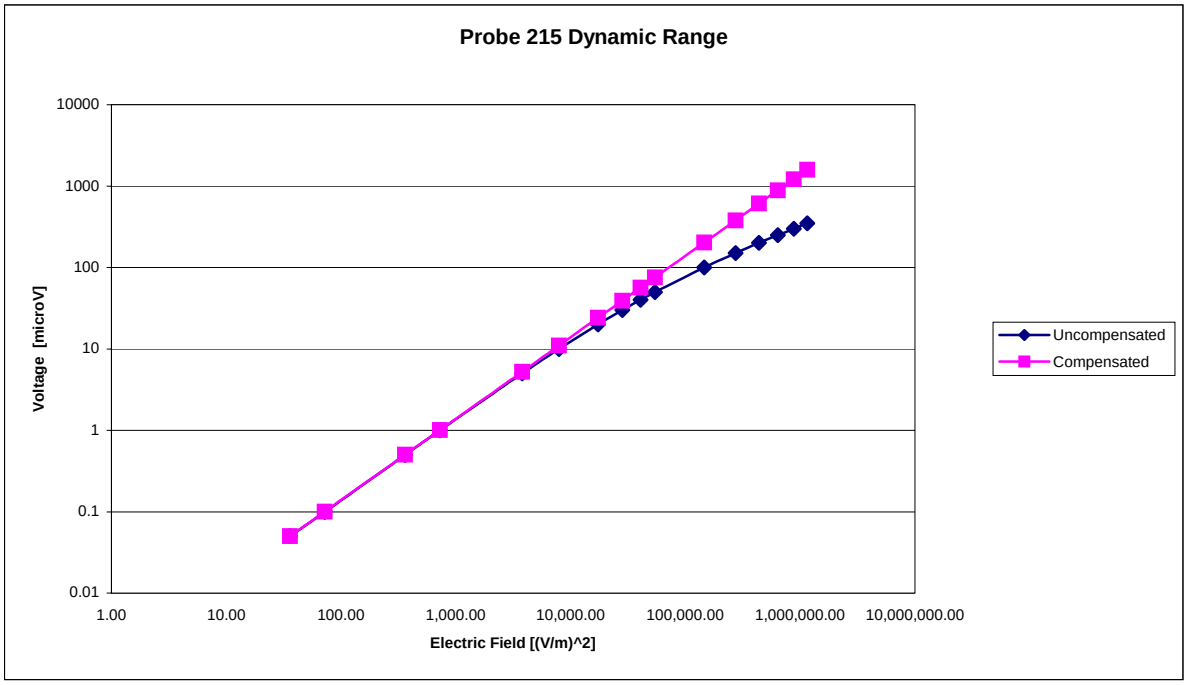
Isotropy Error 5600 MHz (Air)



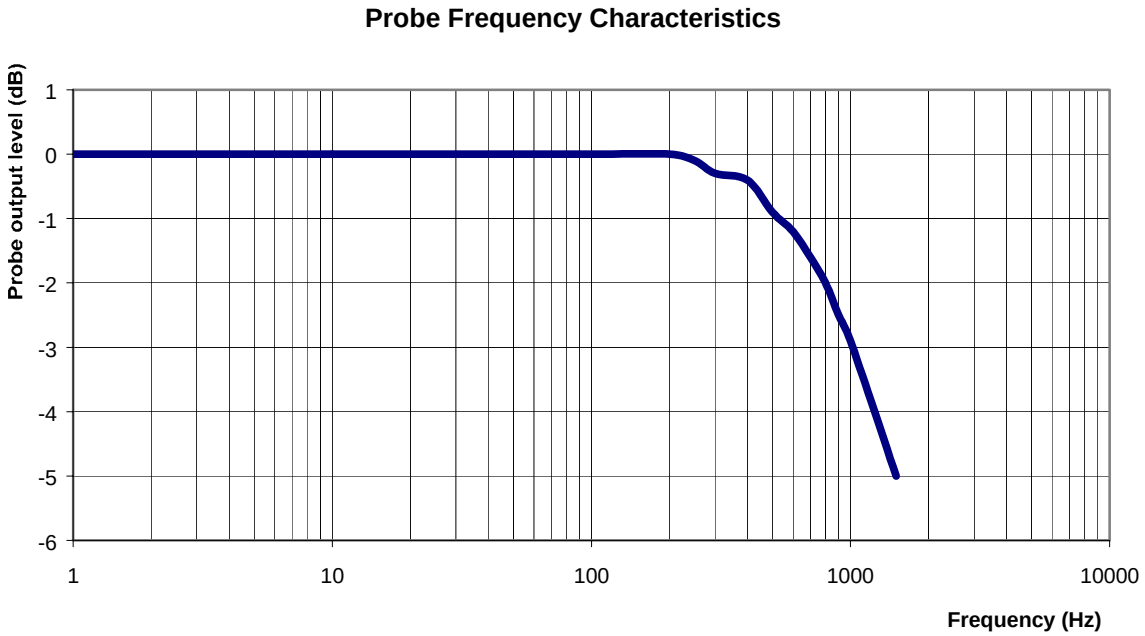


Isotropicity in Tissue: 0.10 dB

Dynamic Range



Video Bandwidth



Video Bandwidth at 500 Hz 1 dB
Video Bandwidth at 1.02 KHz: 3 dB

Conversion Factor Uncertainty Assessment

Frequency:		5600MHz	
Epsilon:	46.0 (+/-5%)	**Sigma:**	6.1 S/m (+/-10%)

ConvF

Channel X:	2.31	7%(K=2)
Channel Y:	2.31	7%(K=2)
Channel Z:	2.31	7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 MΩ.

Boundary Effect:

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2005.

NCL CALIBRATION LABORATORIES

Calibration File No.: CP-609

Client.: RFEL

C E R T I F I C A T E OF C A L I B R A T I O N

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe 5800 MHz

Manufacturer: APREL Laboratories
Model No.: E-020
Serial No.: 215

BODY Calibration

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2
Project No: RFEL-Probe-215-Calibration-5166

Calibrated: 10th June 2005
Released on: 10th June 2005

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: Signature On File

NCL CALIBRATION LABORATORIES
51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6
Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4161

Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 215.

References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure
IEEE 1528 “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”
SSI-TP-011 Tissue Calibration Procedure

Conditions

Probe 215 was a new probe taken from stock prior to calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C
Temperature of the Tissue: 21 °C +/- 0.5°C

We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

Stuart Nicol
Director Product Development

Janusz Lokaj
Member of Engineering Staff
(Calibration Engineer)

Calibration Results Summary

Probe Type:	E-Field Probe E-020
Serial Number:	215
Frequency:	5800 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	**<**5 mm
Tip Length:	60 mm
Total Length:	290 mm

*Resistive to recommended tissue recipes per IEEE-1528

Sensitivity in Air

Channel X:	1.2 $\mu V/(V/m)^2$
Channel Y:	1.2 $\mu V/(V/m)^2$
Channel Z:	1.2 $\mu V/(V/m)^2$
Diode Compression Point:	95 mV

Sensitivity in Body Tissue

Frequency: 5800 MHz

Epsilon: 49.6 (+/-5%) **Sigma:** 6.25 S/m (+/-10%)

ConvF

Channel X: 2.1

Channel Y: 2.1

Channel Z: 2.1

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

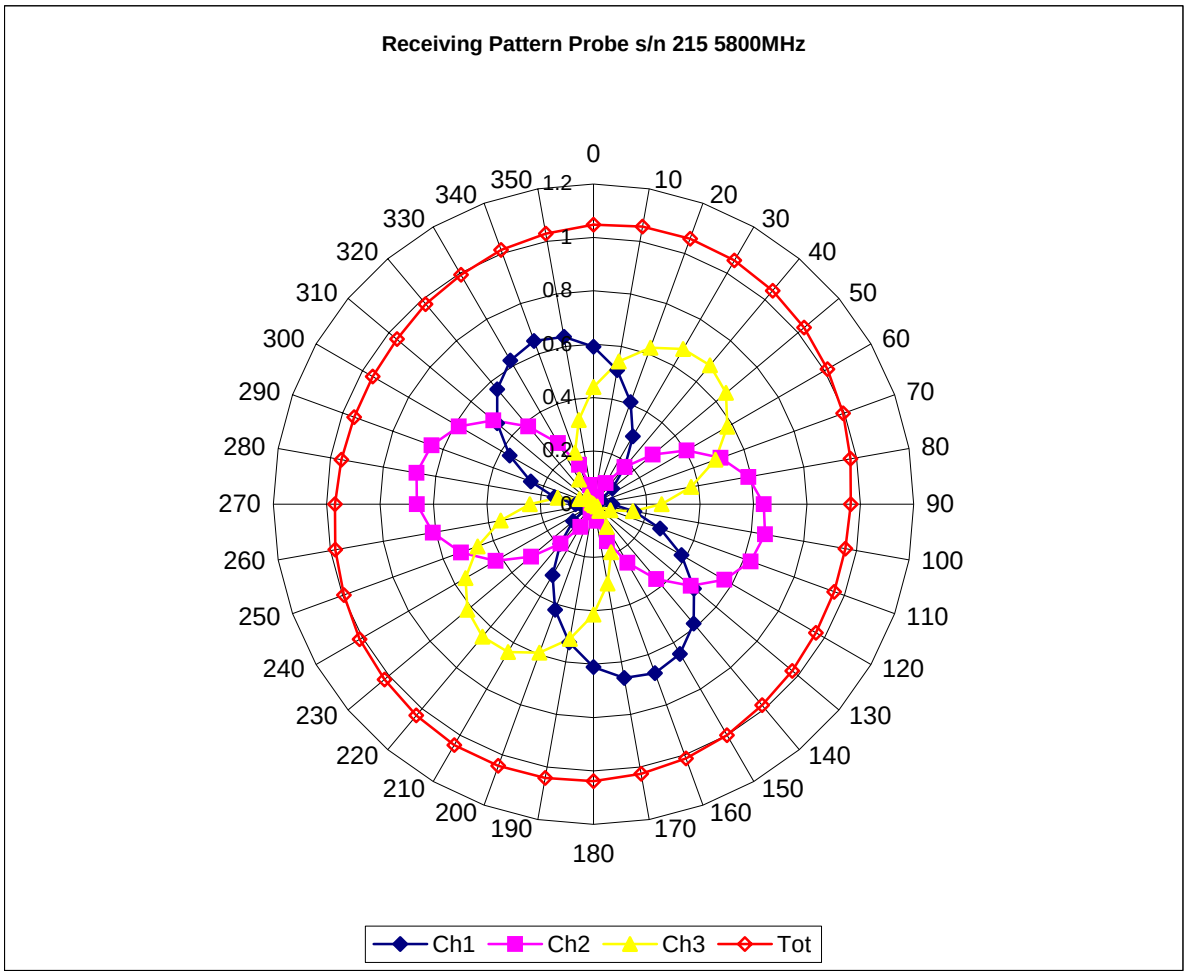
Boundary Effect:

Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.44mm.

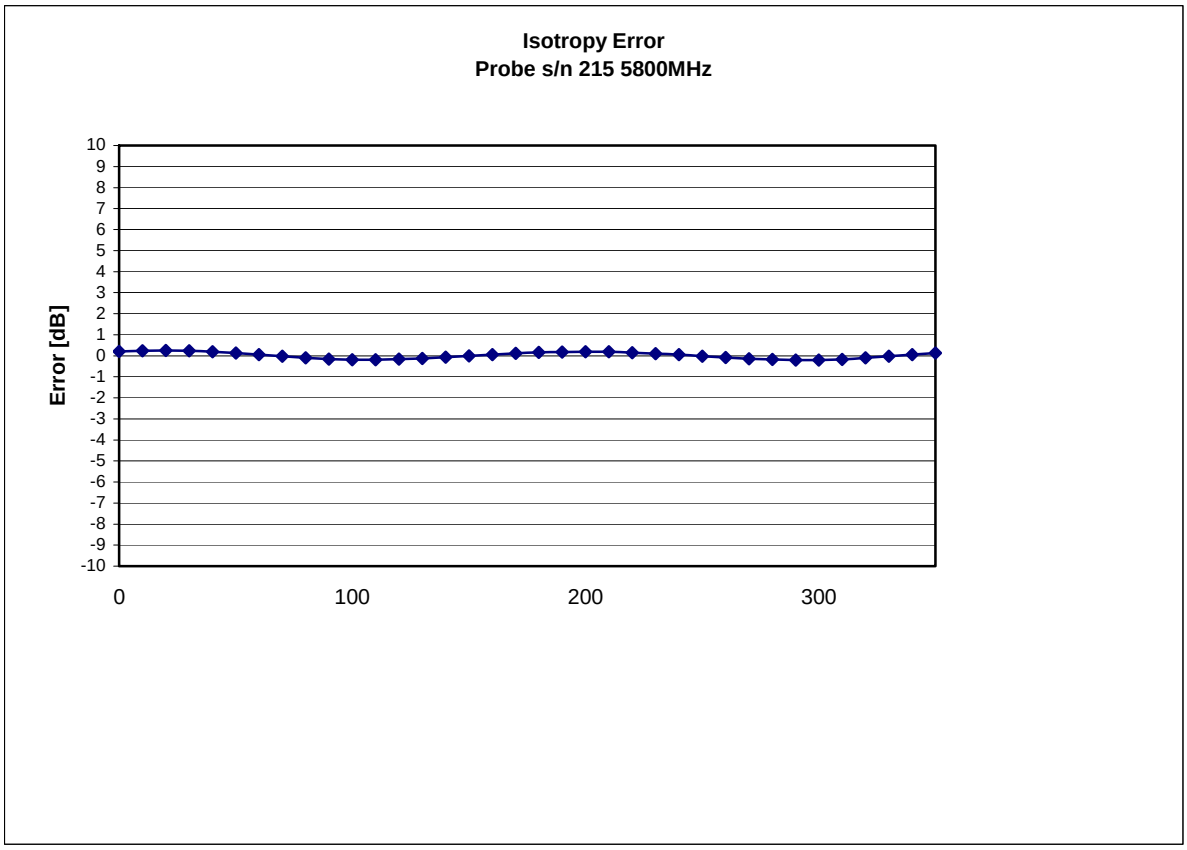
Spatial Resolution:

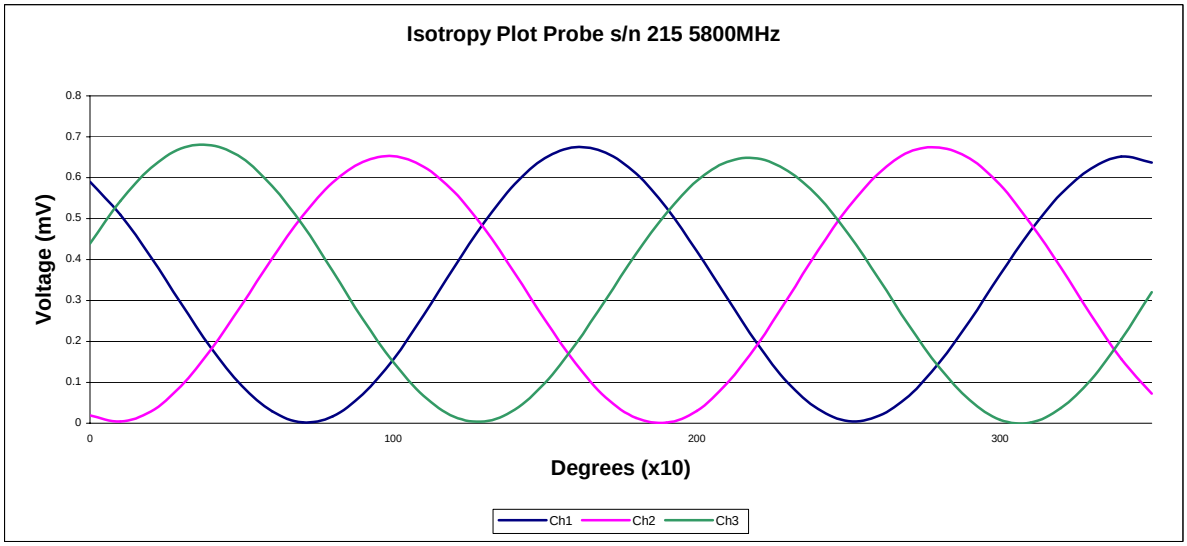
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Receiving Pattern 5800 MHz (Air)



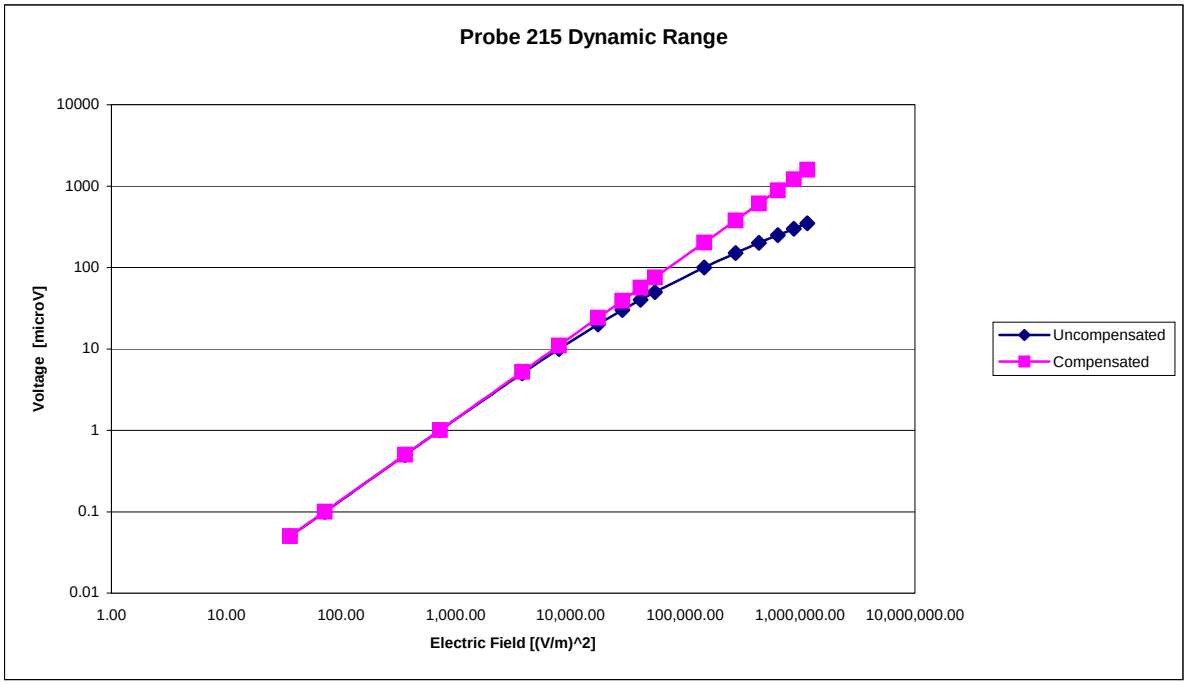
Isotropy Error 5800 MHz (Air)



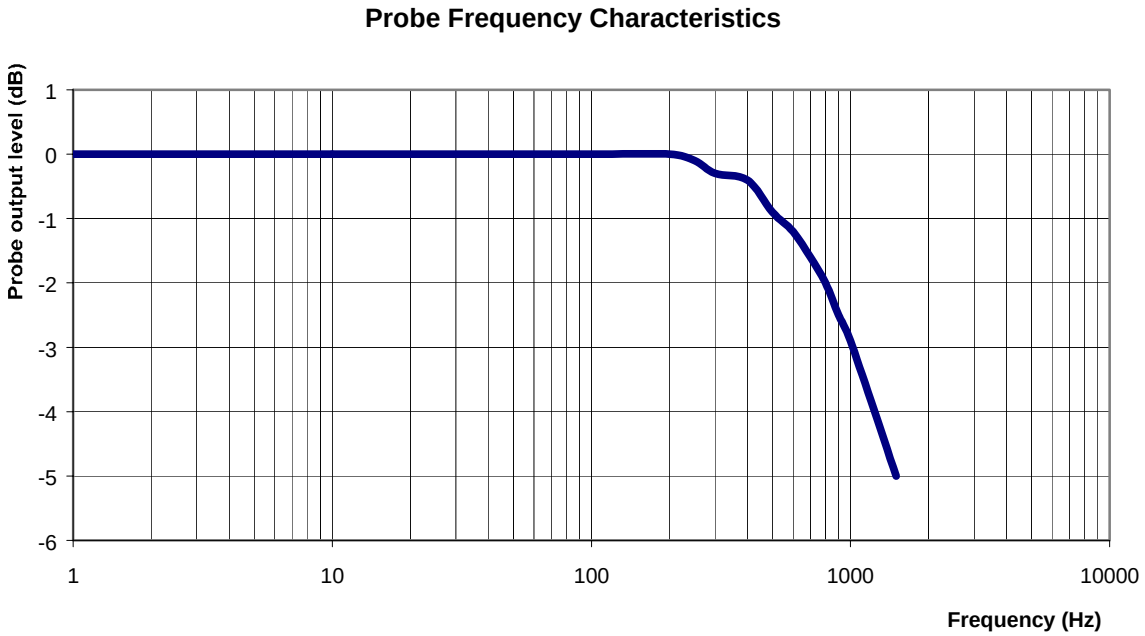


Isotropicity in Tissue: 0.10 dB

Dynamic Range



Video Bandwidth



Video Bandwidth at 500 Hz 1 dB
Video Bandwidth at 1.02 KHz: 3 dB

Conversion Factor Uncertainty Assessment

Frequency:		5800MHz	
Epsilon:	49.6 (+/-5%)	**Sigma:**	6.25 S/m (+/-10%)

ConvF

Channel X:	2.1	7%(K=2)
Channel Y:	2.1	7%(K=2)
Channel Z:	2.1	7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 MΩ.

Boundary Effect:

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2005.

NCL CALIBRATION LABORATORIES

Calibration File No.: CP-606

Client.: RFEL

C E R T I F I C A T E OF C A L I B R A T I O N

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe 2450 MHz

Manufacturer: APREL Laboratories
Model No.: E-020
Serial No.: 215

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2
Project No: RFEL-Probe-215-Calibration-5166

BODY Calibration

Calibrated: 10th June 2005
Released on: 10th June 2005

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: Signature On File

NCL CALIBRATION LABORATORIES
51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6
Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4161

Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 215.

References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure
IEEE 1528 “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”
SSI-TP-011 Tissue Calibration Procedure

Conditions

Probe 215 was a new probe taken from stock prior to calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C
Temperature of the Tissue: 21 °C +/- 0.5°C

We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

Stuart Nicol
Director Product Development

Janusz Lokaj
Member of Engineering Staff
(Calibration Engineer)

Calibration Results Summary

Probe Type:	E-Field Probe E-020
Serial Number:	215
Frequency:	2450 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	**<**5 mm
Tip Length:	60 mm
Total Length:	290 mm

*Resistive to recommended tissue recipes per IEEE-1528

Sensitivity in Air

Channel X:	1.2 $\mu V/(V/m)^2$
Channel Y:	1.2 $\mu V/(V/m)^2$
Channel Z:	1.2 $\mu V/(V/m)^2$
Diode Compression Point:	95 mV

Sensitivity in Body Tissue

Frequency: 2450 MHz

Epsilon: 39.2 (+/-5%) **Sigma:** 1.80 S/m (+/-10%)

ConvF

Channel X: 4.6

Channel Y: 4.6

Channel Z: 4.6

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

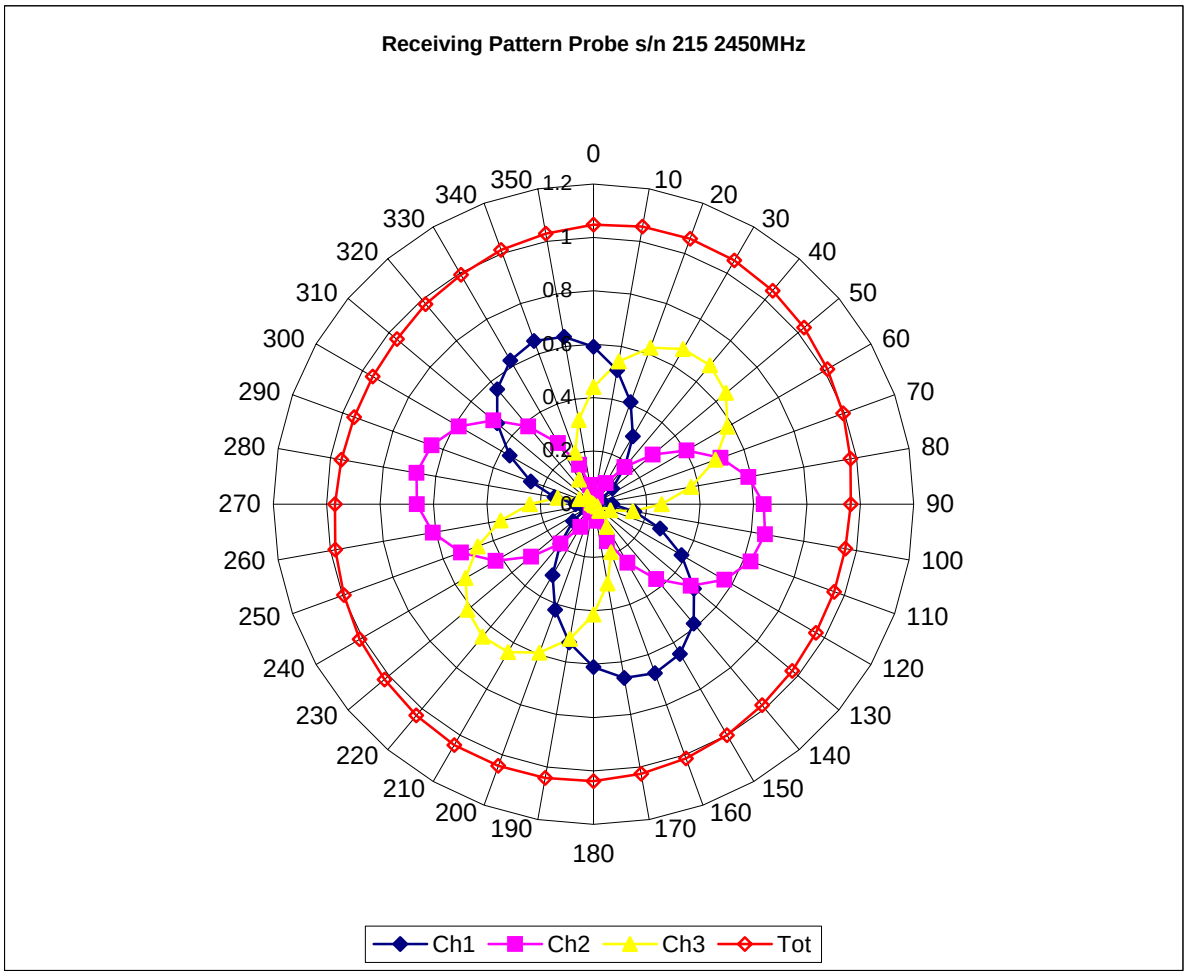
Boundary Effect:

Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.44mm.

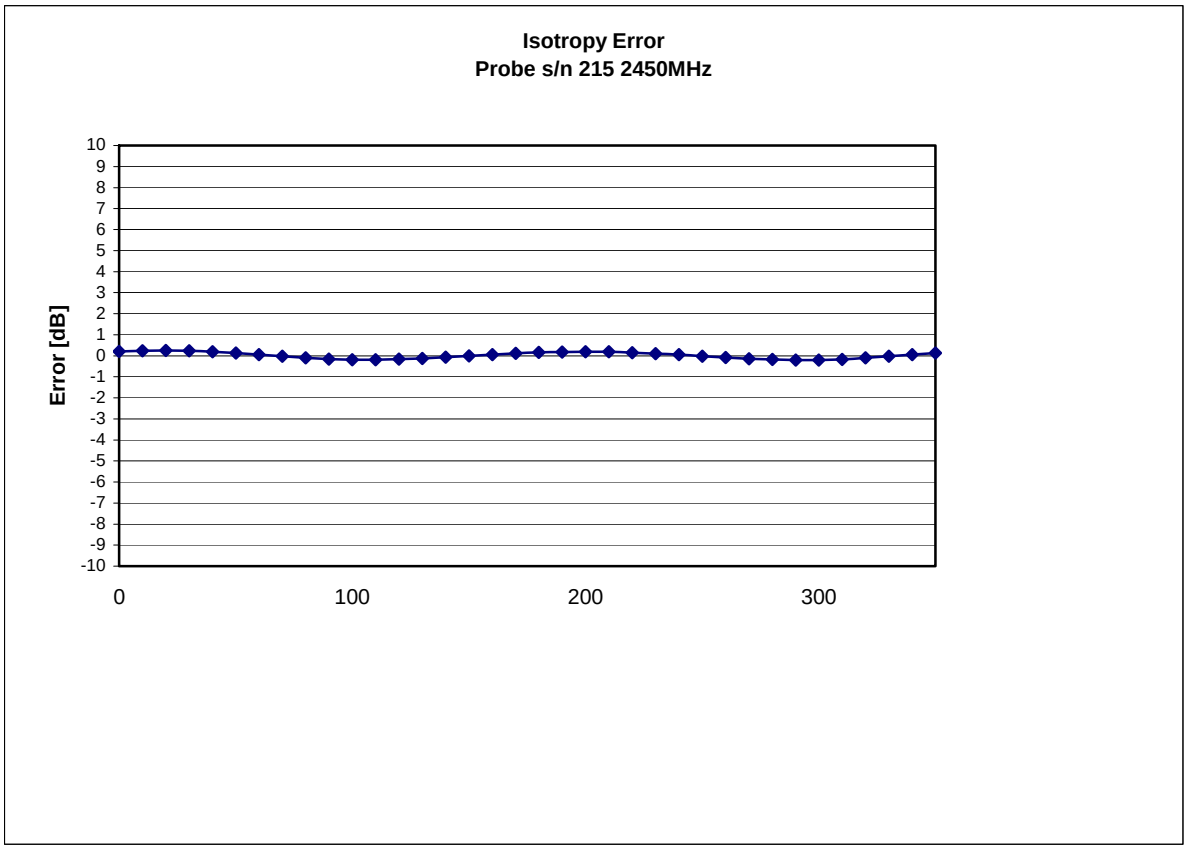
Spatial Resolution:

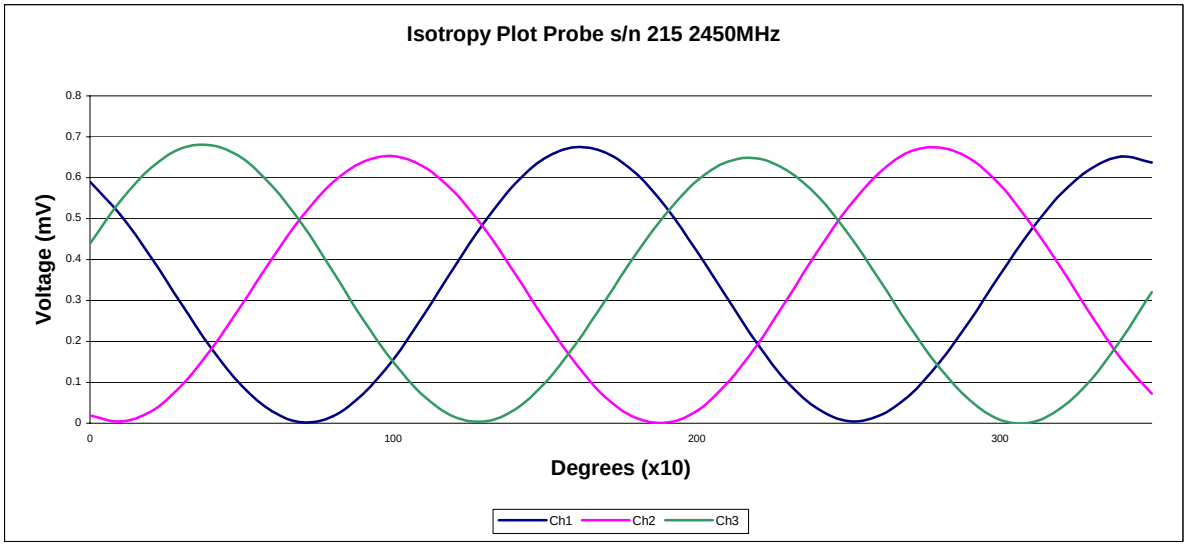
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Receiving Pattern 2450 MHz (Air)



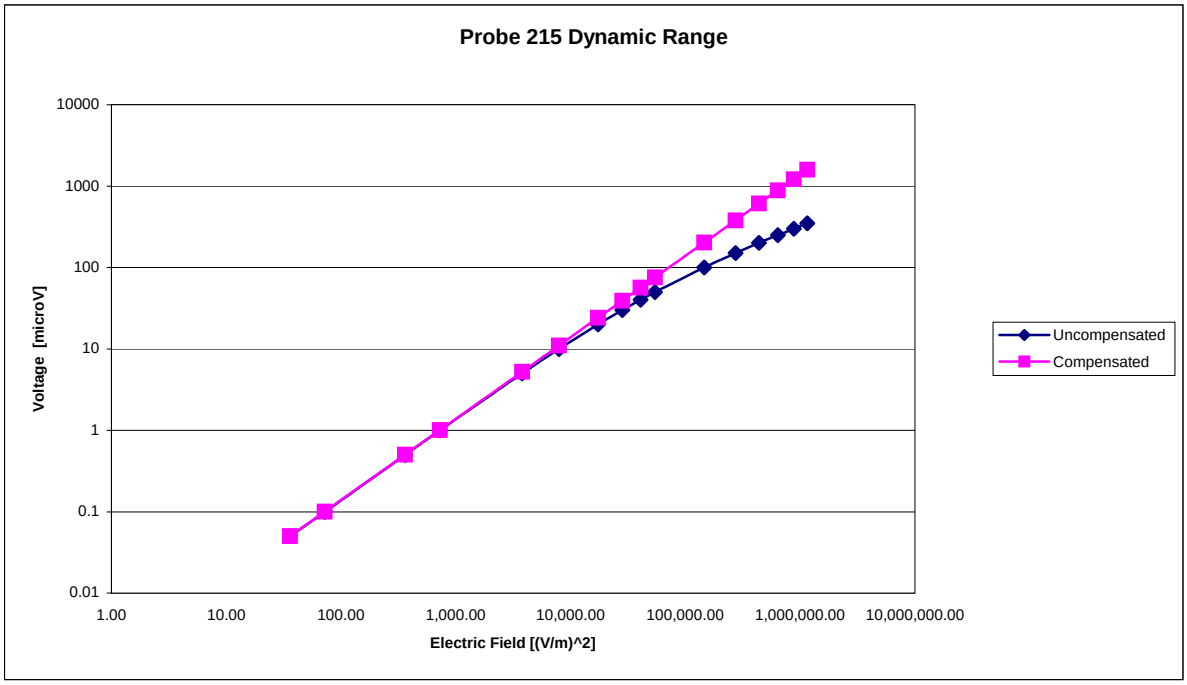
Isotropy Error 2450 MHz (Air)



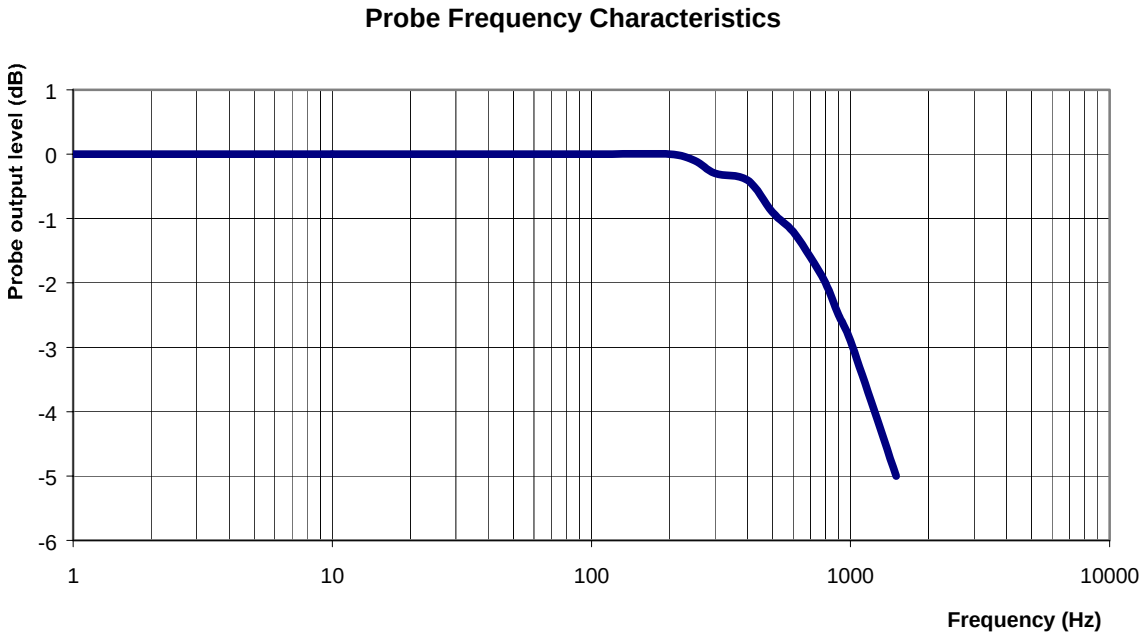


Isotropicity in Tissue: 0.10 dB

Dynamic Range



Video Bandwidth



Video Bandwidth at 500 Hz 1 dB
Video Bandwidth at 1.02 KHz: 3 dB

Conversion Factor Uncertainty Assessment

Frequency:		2450MHz	
Epsilon:	39.2 (+/-5%)	**Sigma:**	1.80 S/m (+/-10%)
ConvF			
Channel X:	4.6	7%(K=2)	
Channel Y:	4.6	7%(K=2)	
Channel Z:	4.6	7%(K=2)	

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 MΩ.

Boundary Effect:

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2005.

Appendix E – Dipole Calibration Data Sheets

NCL CALIBRATION LABORATORIES

Calibration File No: DC-591
Project Number: RFEL-CAL-D-5258-5163

CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

RFEL Validation Dipole

Manufacturer: APREL Laboratories
Part number: ALS-D-5258-S-2
Frequency: 5.2GHz to 5.8GHz
Serial No: 5258-235-00801

Customer: RFEL

Calibrated: 24th May 2005
Released on: 24th May 2005

Released By: _____

NCL CALIBRATION LABORATORIES
51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6
Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4162

Conditions

Dipole 5258-235-00801 was new and taken from stock prior to calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C
Temperature of the Tissue: 21 °C +/- 0.5°C

We the undersigned attest that to the best of our knowledge the calibration of this device has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

Stuart Nicol
Director Product Development

D. Brooks
Member of Engineering Staff
(Calibration Engineer)

This page has been reviewed for content and attested to by signature within this document.

Calibration Results Summary

The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

Mechanical Dimensions

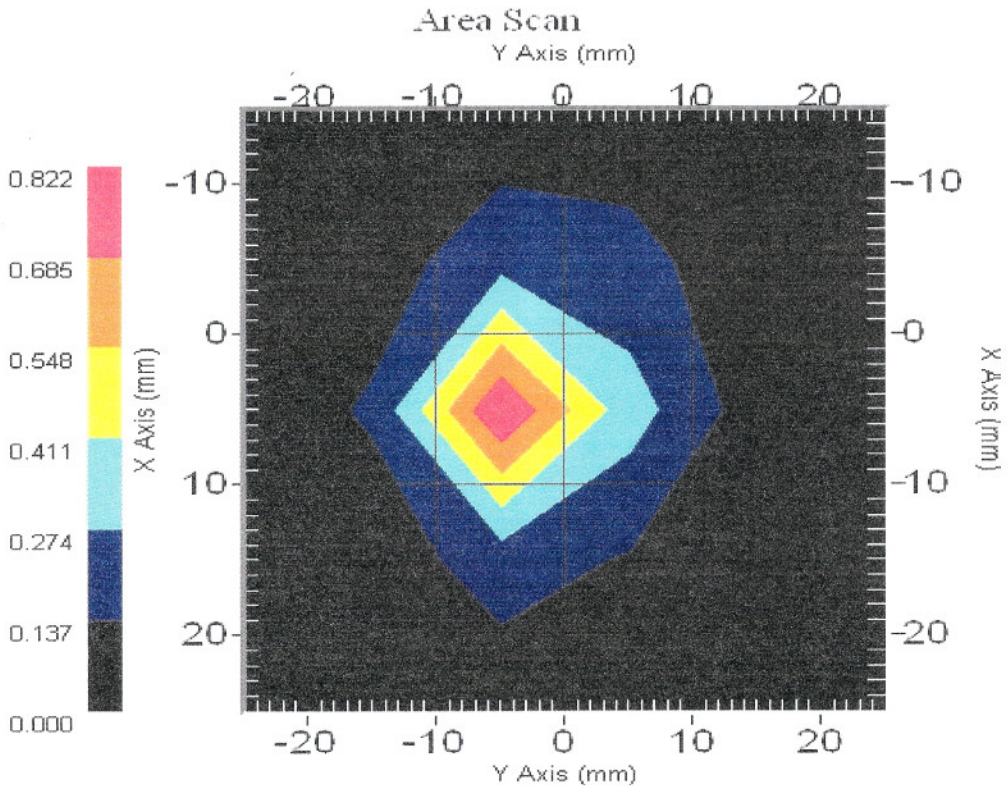
Length: 23.3 mm
Height: 20.3 mm

Electrical Specification

SWR: 1.22 U
Return Loss: -20.0 dB
Impedance: 50.0 Ω

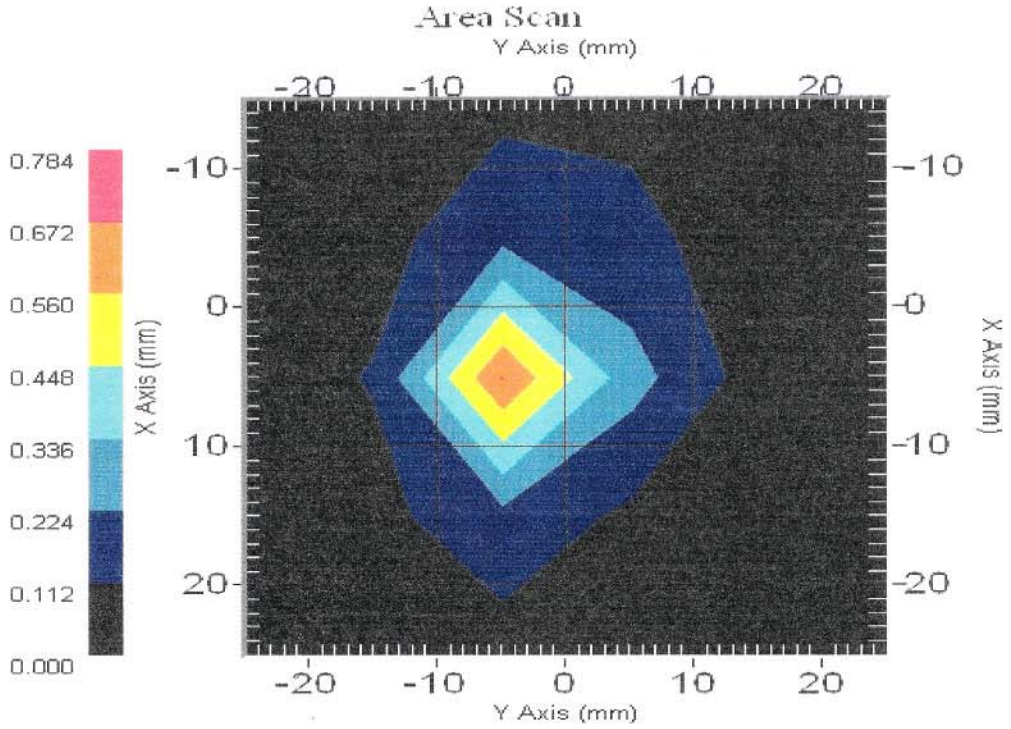
System Validation Results

Frequency	1 Gram	10 Gram	Peak
5200 MHz	62.9	17.9	223.1



This page has been reviewed for content and attested to by signature within this document.

Frequency	1 Gram	10 Gram	Peak
5800 MHz	58.3	18	207.1



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Introduction

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 5258-235-00801. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 130 MHz to 26 GHz E-Field Probe Serial Number 212.

References

SSI-TP-018-ALSAS Dipole Calibration Procedure
SSI-TP-016 Tissue Calibration Procedure
IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"

Conditions

Dipole 5258-235-00801 was new taken from stock.

Ambient Temperature of the Laboratory:	22 °C +/- 0.5°C
Temperature of the Tissue:	20 °C +/- 0.5°C

Dipole Calibration Results

Tissue Validation

Head Tissue 5200 MHz	Measured
Dielectric constant, ε_r	35.3
Conductivity, σ [S/m]	5.30

Head Tissue 5800 MHz	Measured
Dielectric constant, ε_r	35.3
Conductivity, σ [S/m]	5.30

Mechanical Verification

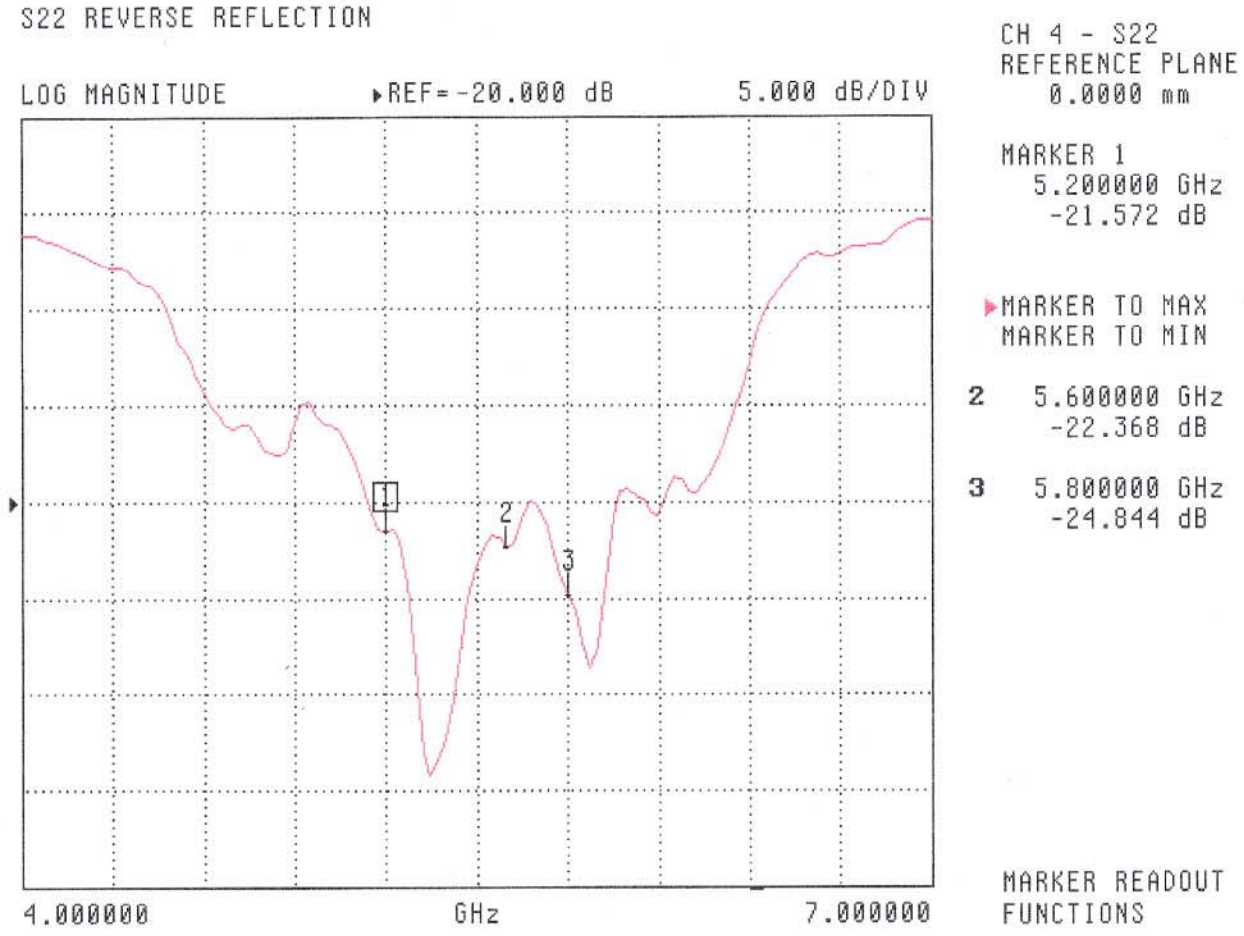
APREL Length	APREL Height	Measured Length	Measured Height
23.1 mm	20.7 mm	23.3 mm	20.3 mm

Electrical Calibration

S11	5200MHz	5800MHz
RL (dB)	-21.6	-24.8
SWR	1.19	1.12
Impedance (ohms)	45.6	50.7

The Following Graphs are the results as displayed on the Vector Network Analyzer.

S11 Parameter Return Loss



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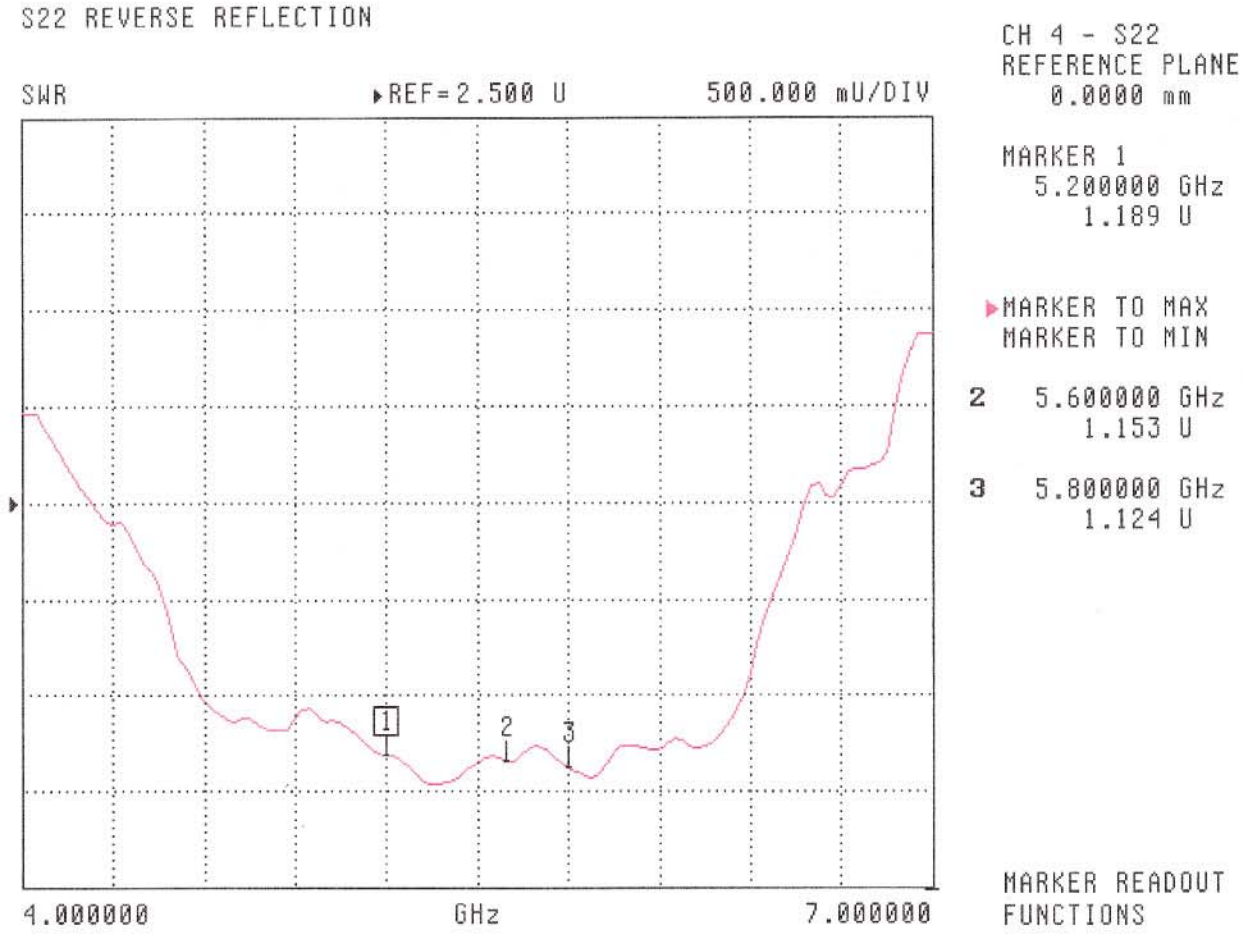
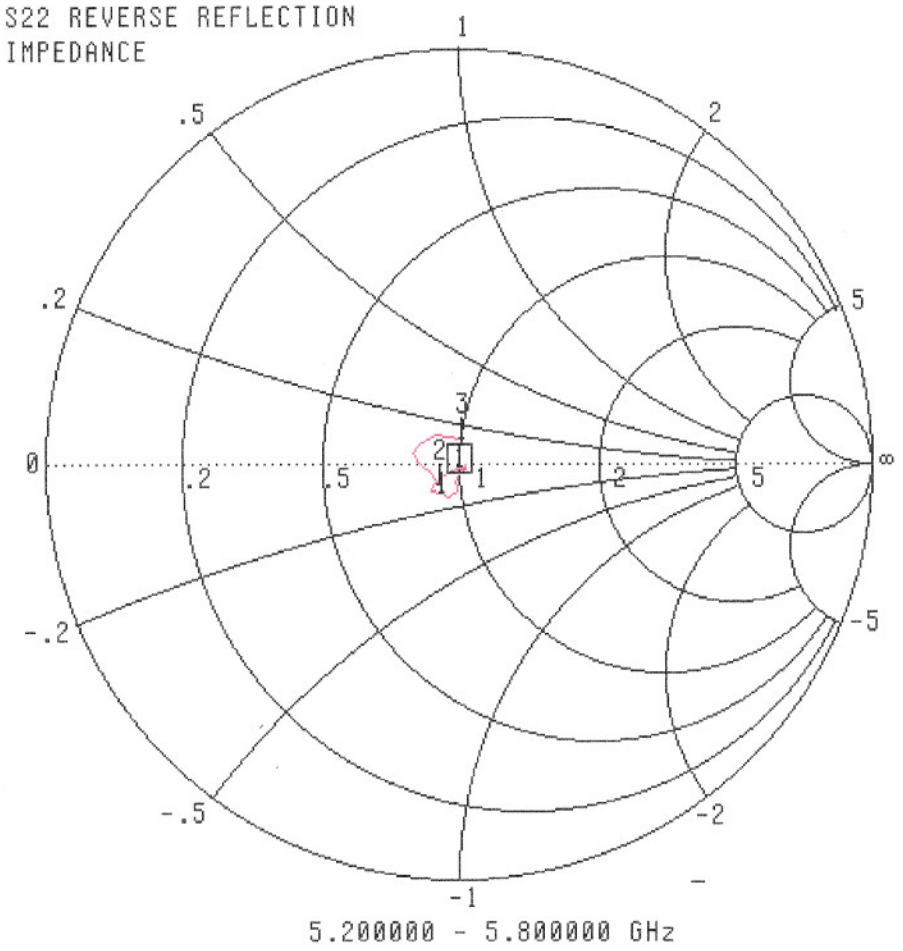
SWR



Smith Chart Dipole Impedance



CH 4 - S22
REFERENCE PLANE
0.0000 mm

MARKER 1
5.200000 GHz
45.566 Ω
-6.839 jΩ

▶MARKER TO MAX
MARKER TO MIN

2 5.600000 GHz
45.348 Ω
-4.725 jΩ
3 5.800000 GHz
50.691 Ω
5.736 jΩ

MARKER READOUT
FUNCTIONS

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